

RADIATION

environmental
implications

and

MAN

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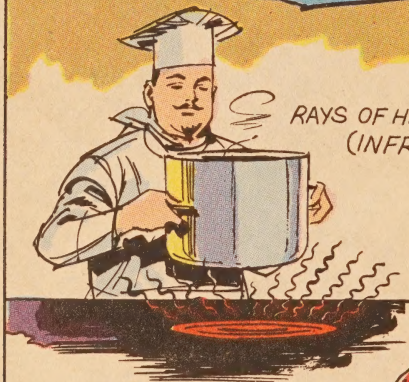
RADIATION IS THE CONDITION
WHEREBY ENERGY IS DIRECTED FROM A
CENTRAL POINT OUTWARD

IT IS AS OLD AS THE
UNIVERSE ITSELF.
HERE ARE SOME
FORMS OF RADIATION
KNOWN TO US ALL.

SUNRAYS
(ULTRA-VIOLET)



RAYS OF HEAT
(INFRA RED)



RAYS OF LIGHT



RADIOACTIVE SUBSTANCES HAVE ALWAYS BEEN PRESENT ON EARTH, IN OUR BODIES, IN THE WATER, SOIL, AND AIR.

THESE MATERIALS SEND OUT RADIATION. SINCE THEY HAVE ALWAYS EXISTED ALL AROUND US, THEY ARE POPULARLY REFERRED TO AS "BACKGROUND RADIATION."



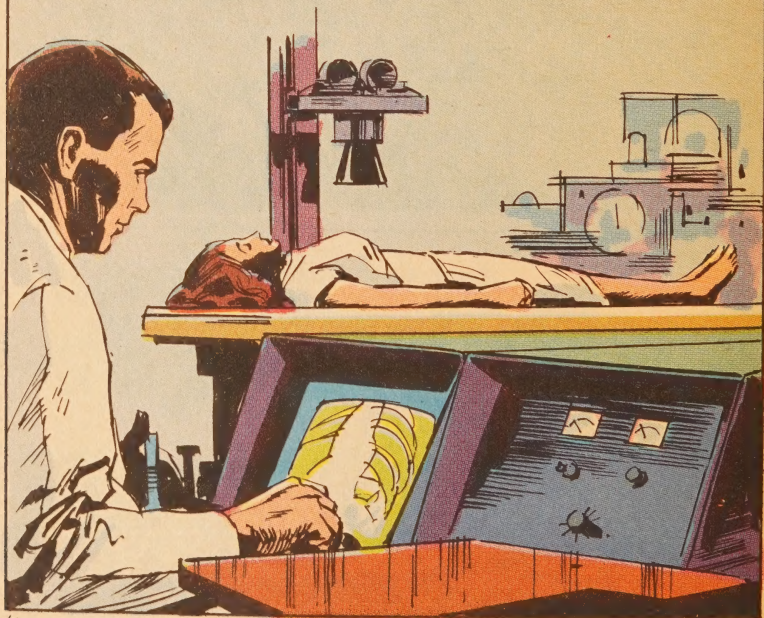
SOME OF THE WORLD'S LARGEST DEPOSITS OF URANIUM ---- AMONG THE MOST IMPORTANT INGREDIENTS OF NUCLEAR POWER --- EXIST IN CANADA AS NATURAL RESOURCES.

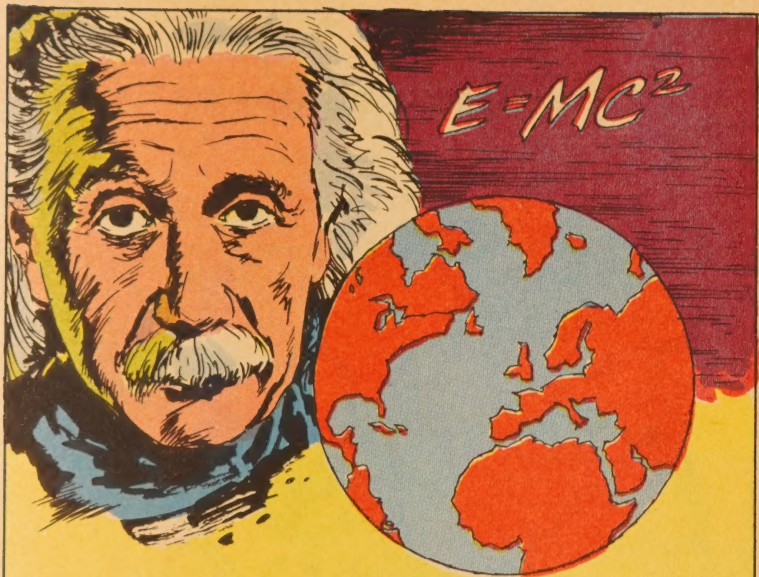


MAN-MADE RADIATION

IN 1895, IN GERMANY, X-RAYS PRODUCED THROUGH THE USE OF ELECTRICAL MACHINES WERE DISCOVERED. HERE WAS THE FIRST EXAMPLE OF PENETRATING RADIATION BEING DIRECTED TOWARD A SPECIFIC OBJECT. X-RAYS ENABLE THE MEDICAL PROFESSION TO LOCATE BONE FRACTURES, EXAMINE CHEST AILMENTS, IDENTIFY TOOTH DECAY AND MUCH MORE.

ONE OF THE GREAT BLESSINGS TODAY IS THE BENEFIT OF RADIATION IN THE TREATMENT OF CANCER.





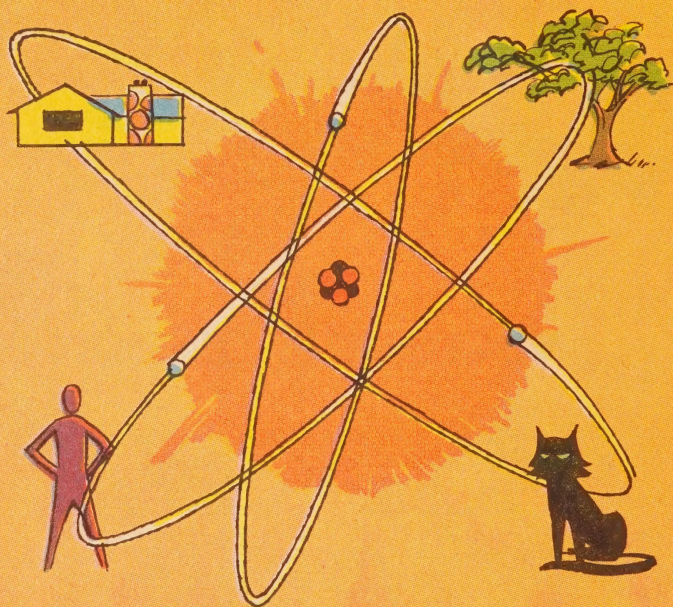
NUCLEAR RADIATION

TODAY "NUCLEAR RADIATION" IS A HOUSEHOLD TERM. THIS NEW SOURCE OF ENERGY IS BRINGING UNTOLD BENEFITS TO MANKIND. AS WITH ALL FORMS OF ENERGY THERE ARE SOME HAZARDS INVOLVED WHEN IT IS HANDLED CARELESSLY.

NOW, WHAT WILL THE ENERGY FROM NUCLEAR RADIATION DO FOR US? LET'S TRY TO EXPLAIN IT SIMPLY IF WE CAN.

THE ATOM

EVERYTHING IN THE WORLD -
EVERYBODY IN THE WORLD -
- IS COMPOSED OF VARIOUS
SUBSTANCES (CHEMICAL ELEMENTS).
NOW, THE SMALLEST PART OF EACH
SUBSTANCE IS CALLED AN "ATOM"



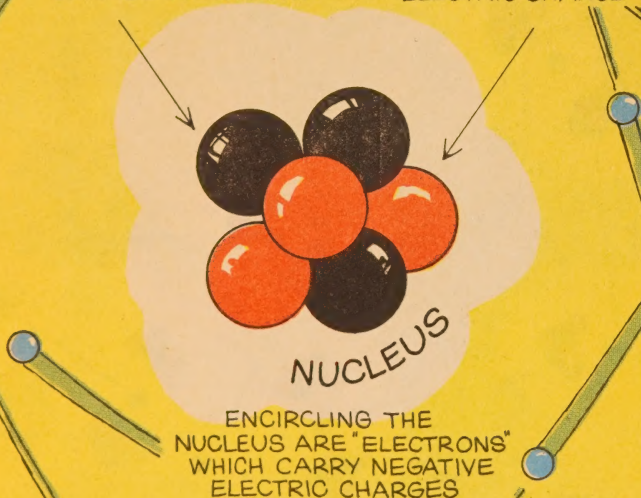
AN ATOM IS SO SMALL THAT IT CANNOT BE
SEEN EVEN WITH THE MOST POWERFUL
MICROSCOPE. WE KNOW THAT THE ATOM IS
THE CORE OF EVERY ELEMENT
IN THE UNIVERSE.

INSIDE THE ATOM

EVERY ATOM IS MADE UP OF THREE PARTS,
IN VARIOUS COMBINATIONS.

THERE ARE "PROTONS"
WHICH CARRY
POSITIVE ELECTRIC
CHARGES

....."NEUTRONS"
WHICH CARRY NO
ELECTRIC CHARGE

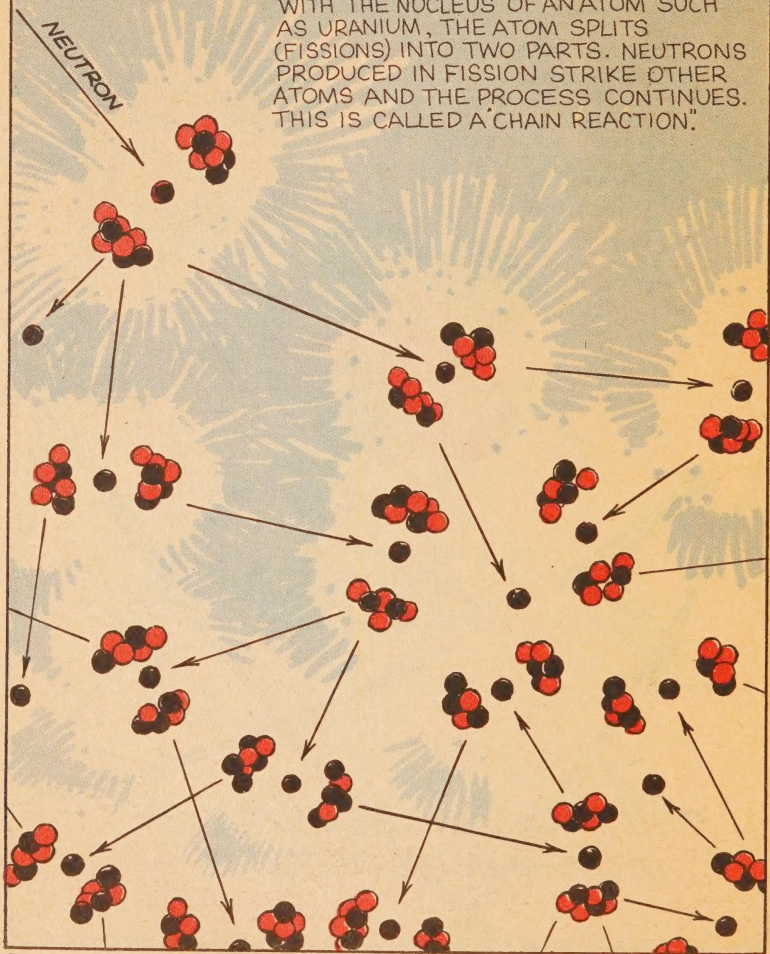


ENCIRCLING THE
NUCLEUS ARE "ELECTRONS"
WHICH CARRY NEGATIVE
ELECTRIC CHARGES

*THE ATOM'S VAST ENERGY IS
STORED IN ITS NUCLEUS*

FISSION

WHEN A NEUTRON COMES INTO CONTACT WITH THE NUCLEUS OF AN ATOM SUCH AS URANIUM, THE ATOM SPLITS (FISSIONS) INTO TWO PARTS. NEUTRONS PRODUCED IN FISSION STRIKE OTHER ATOMS AND THE PROCESS CONTINUES. THIS IS CALLED A 'CHAIN REACTION'.



RADIOACTIVE ATOMS THROW OFF RADIATIONS IN ALL DIRECTIONS IN THE FORM OF FAST-FLYING PARTICLES OR RAYS.

ALPHA PARTICLES

SOME OF THESE PARTICLES ARE CALLED "ALPHA PARTICLES. THEY TRAVEL ONLY AN INCH OR SO IN AIR AND HAVE LITTLE OR NO PENETRATING POWER.

BETA PARTICLES

OTHER PARTICLES ARE CALLED "BETA PARTICLES". THEY TRAVEL A FEW FEET IN AIR BUT WILL NOT PENETRATE MUCH BEYOND THE DEPTH OF A PERSON'S SKIN.

GAMMA RAYS

STILL STRONGER RAYS ARE REFERRED TO AS "GAMMA RAYS". THEY TRAVEL AT THE SPEED OF LIGHT. ONLY SUCH MATERIALS AS THICK LEAD OR CONCRETE ARE EFFECTIVE IN STOPPING THEM.

WOOD

WOOD

CONCRETE

THE EFFECTS OF TOO MUCH RADIATION

OVER-EXPOSURE TO RADIATION MAY DAMAGE OR KILL SOME OF THE TINY LIVING CELLS WHICH COMPOSE OUR BODY.



LARGE AMOUNTS OF RADIATION OR REPEATEDLY HIGH EXPOSURE TO IT MAY UPSET THE BODY'S FUNCTIONS OR PRODUCE SERIOUS DISEASES, SUCH AS CANCER OR LEUKEMIA IN LATER LIFE.

UNNECESSARY EXPOSURE OF BODY ORGANS AND CELLS TO RADIATION MAY HAVE THE EFFECT OF INCREASING THE NUMBER OF NATURALLY INHERITED PHYSICAL DEFECTS IN CHILDREN OF FUTURE GENERATIONS.

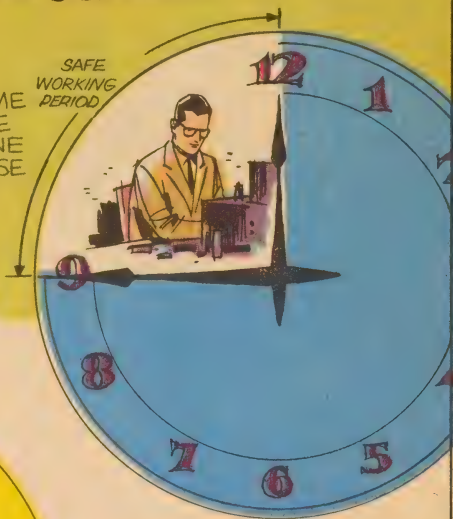


RADIATION PROTECTION

TODAY, PROTECTION AGAINST EXTERNAL RADIATION IS **HIGHLY EFFECTIVE**. THERE ARE THREE MAJOR FACTORS INVOLVED. THEY ARE :

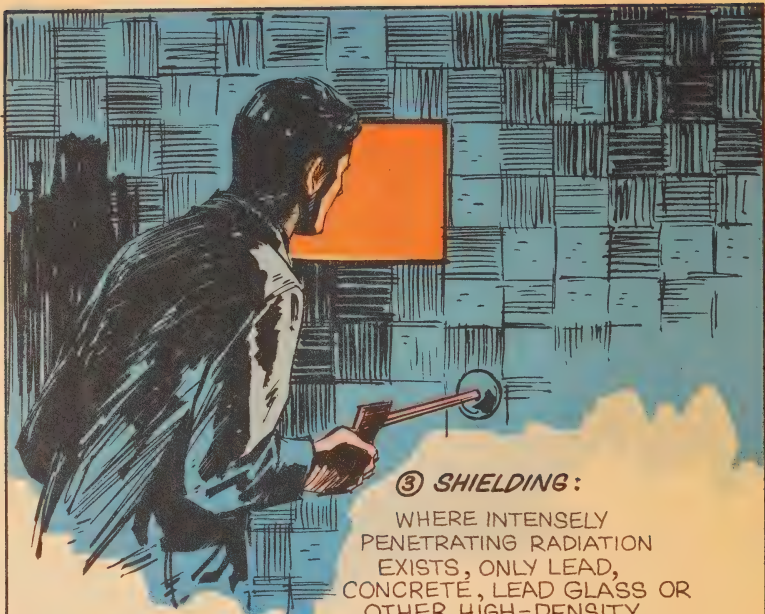
① TIME ② DISTANCE ③ SHIELDING

① **TIME** : IN ANY AREA WHERE RADIATION EXISTS, SENSIBLE TIME EXPOSURE LIMITS ARE ESTABLISHED. ANYONE WHO ABIDES BY THESE REGULATIONS NEED HAVE NO FEAR FOR HIS WELL-BEING.



② **DISTANCE** : SIMILARLY, SAFE DISTANCE FROM THE SOURCE OF RADIATION IS AN IMPORTANT FACTOR IN MAINTAINING SAFETY. THE EFFECT OF RADIATION FALLS OFF SHARPLY AS YOU INCREASE YOUR DISTANCE FROM ITS SOURCE.

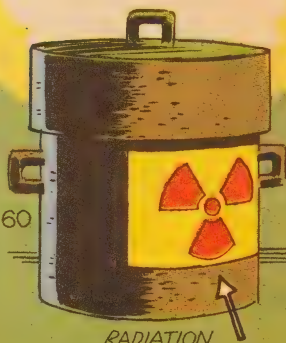




③ SHIELDING:

WHERE INTENSELY
PENETRATING RADIATION
EXISTS, ONLY LEAD,
CONCRETE, LEAD GLASS OR
OTHER HIGH-DENSITY
MATERIALS WILL PROVIDE THE
NECESSARY PROTECTION.

THIS IS A "CASTLE"—
A CONTAINER USED FOR
THE STORAGE OF COBALT-60
AND OTHER RADIOACTIVE
MATERIALS. MADE OF
THICK LEAD AND STEEL,
IT SHIELDS PEOPLE FROM
ESCAPING RADIATION.



RADIATION
WARNING SYMBOL

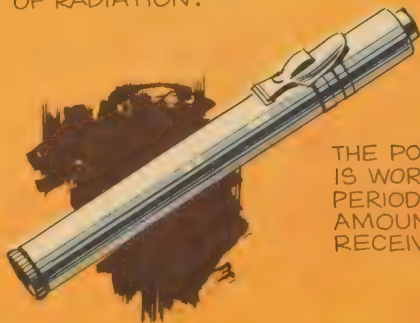
MEASURING RADIATION

A FACTOR IN RADIATION CONTROL IS THAT IT MAY BE MEASURED EASILY AND ACCURATELY BY SEVERAL TYPES OF INSTRUMENTS. AMONG THESE THERE IS :



THE "FILM BADGE", WORN BY RADIATION WORKERS, IT PROVIDES A PERMANENT RECORD OF THE WORKER'S RADIATION EXPOSURE IN A GIVEN PERIOD OF TIME.

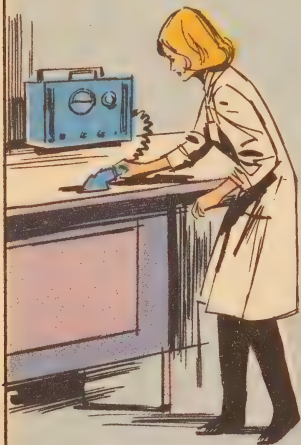
THE "GEIGER COUNTER" AND INSTRUMENTS OF SIMILAR TYPE. THEY DETECT AND MEASURE THE INTENSITY OF RADIATION.



THE POCKET "DOSIMETER" IS WORN ON A PERSON TO PERIODICALLY CHECK THE AMOUNT OF RADIATION RECEIVED.

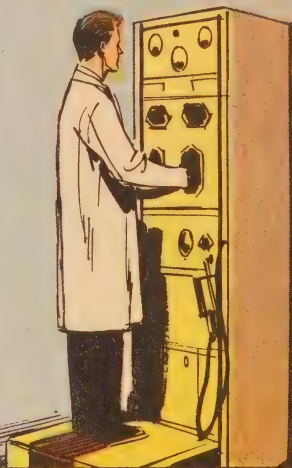
PROTECTION AGAINST RADIOACTIVE CONTAMINATION

IN NUCLEAR PLANTS, PROTECTIVE CLOTHING MAY BE WORN TO: ① PREVENT LOOSE RADIOACTIVE MATERIAL FROM CONTAMINATING THE SKIN. ② GUARD AGAINST THE INHALING OR SWALLOWING OF SUCH MATERIAL.



METERS MEASURE THE AMOUNT OF RADIOACTIVITY IN THE AIR, ON TABLE-TOPS, DOORS, FLOORS, WALLS, ETC.

IN NUCLEAR INDUSTRIES, EMPLOYEES ARE EXAMINED FOR ANY TRACE OF RADIOACTIVE CONTAMINATION AFTER EACH SHIFT ON DUTY.



WHY THE NUCLEAR INDUSTRY IS SAFE

THE ATOMIC ENERGY INDUSTRY IS PROUD THAT ITS SAFETY RECORD STANDS ABOVE ALL OTHERS. BY INTERNATIONAL AGREEMENT, DEFINITE LIMITS HAVE BEEN ESTABLISHED GOVERNING RADIATION EXPOSURE.

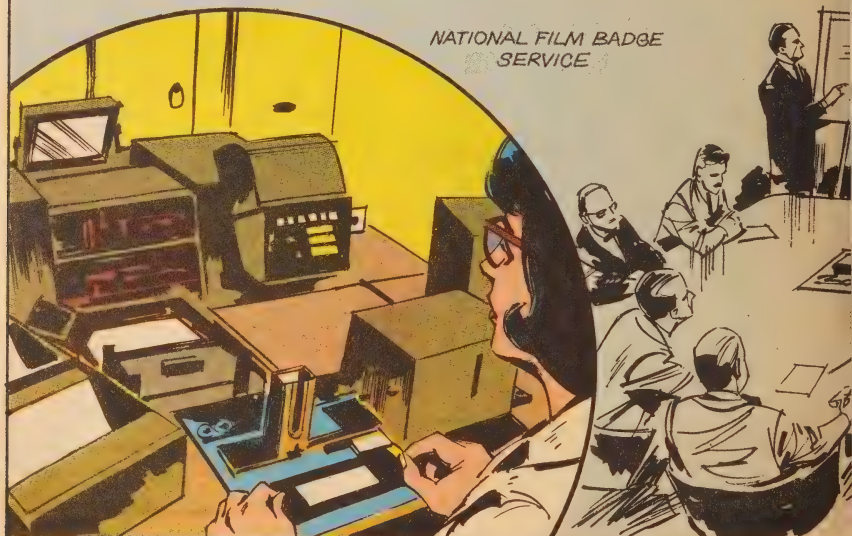
THROUGH NATIONAL AND LOCAL ORGANIZATIONS, THESE STANDARDS ARE SCRUPULOUSLY ENFORCED IN CANADA - AND THESE VIGILANT ORGANIZATIONS WILL CONTINUE TO PROTECT THE CANADIAN PUBLIC - DAY AND NIGHT.



PROTECTING

THE RADIATION PROTECTION DIVISION OF THE DEPARTMENT OF NATIONAL HEALTH AND WELFARE GUARDS THE HEALTH OF ALL CANADIANS BY :

- A- ADVISING ON THE SAFE USE OF RADIATION
- B- PROVIDING SAFETY SUPERVISION THROUGH ITS **NATIONAL FILM BADGE SERVICE**
- C- CONDUCTING RADIATION SURVEYS IN COLLABORATION WITH PROVINCIAL DEPARTMENTS OF HEALTH.
- D- ASSESSING INTERNAL RADIATION HAZARD THROUGH ITS **WHOLE BODY COUNTER** AND OTHER LAB SERVICES.
- E- SHORT-TERM RADIATION PROTECTION TRAINING COURSES.



NATIONAL FILM BADGE
SERVICE

CANADIANS

THE ATOMIC ENERGY CONTROL BOARD
ON THE RECOMMENDATION OF FEDERAL AND
PROVINCIAL DEPARTMENTS OF HEALTH, IS
THE AGENCY IN CANADA WHICH:

A- LICENCES THE USE OF ALL RADIOACTIVE
MATERIALS.

B- ON THE RECOMMENDATION OF ITS **REACTOR
SAFETY ADVISORY COMMITTEE** ISSUES
LICENCES FOR THE OPERATION OF ALL
NUCLEAR REACTORS.

MANY REPUTABLE INDUSTRIES AND UTILITIES
HAVE JOINED TOGETHER, AS THE
CANADIAN NUCLEAR ASSOCIATION, TO
PROMOTE THE SAFE USE OF RADIOACTIVE
MATERIALS.

*WHOLE BODY
COUNTER*



THE RADIATION PROTECTION DIVISION
CARRIES ON A CONTINUOUS NATION-WIDE
PROGRAMME TO STUDY BACKGROUND
RADIATION AND LEVELS OF RADIOACTIVE
FALLOUT, TO FURTHER PROTECT THE
CANADIAN PUBLIC.

IN CANADA'S NORTHLAND,
CARIBOU MEAT AND HUMANS
ARE CHECKED FOR CESIUM-137, A
COMPONENT OF FALLOUT.

IN SOUTHERN CANADA, FRESH
MILK IS REGULARLY CHECKED
FOR STRONTIUM-90 AND
CESIUM-137.



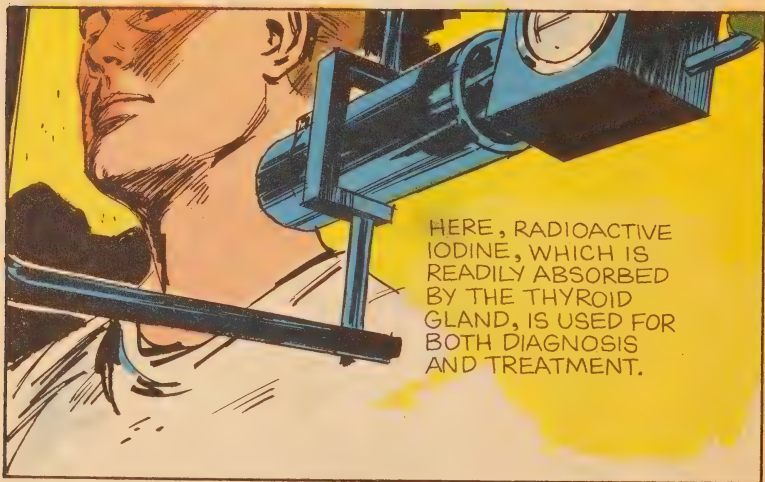
ATOMS AT WORK

WHEN ATOMS OF ONE CHEMICAL ELEMENT (IRON, URANIUM, ETC.) ARE FOUND TO HAVE DIFFERENT WEIGHTS THEY ARE CALLED "ISOTOPES". SOME ISOTOPES, BEING RADIOACTIVE, THROW OFF RADIATIONS. WATCH HOW ATOMIC ENERGY, IN THE FORM OF RADIOACTIVE ISOTOPES, SERVES ALL MANKIND AND IN SO MANY WAYS!

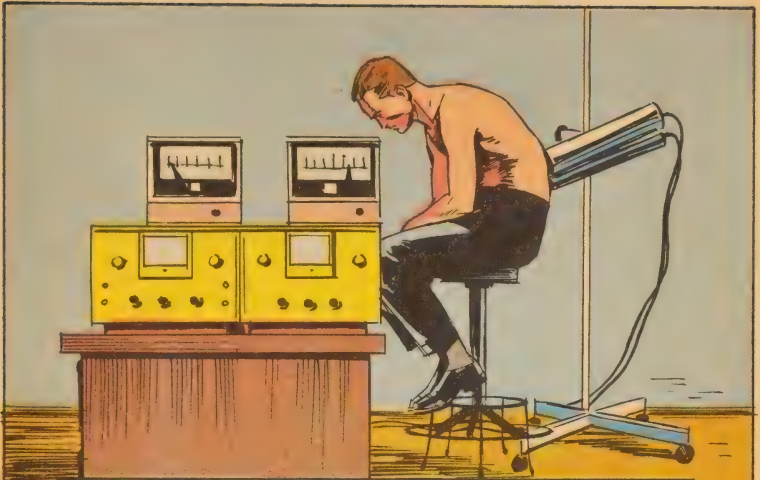


RADIATION AND GOOD HEALTH

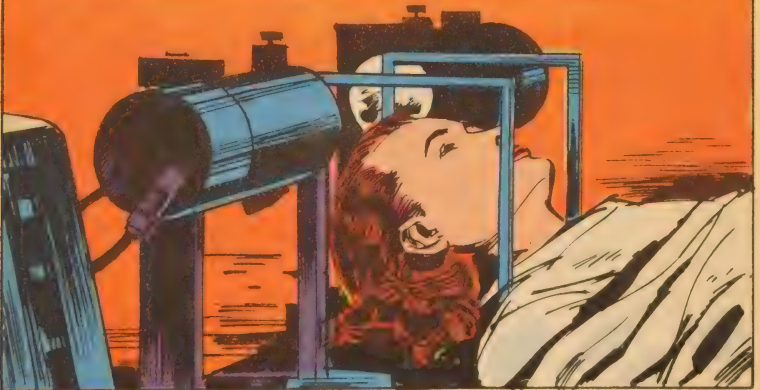
RADIOACTIVE ISOTOPES ARE BEING USED INCREASINGLY IN THE DIAGNOSIS AND TREATMENT OF MANY DISEASES. IN THE TREATMENT OF CANCER, A BEAM OF PENETRATING GAMMA RAYS CAN BE FOCUSED ON THE TUMOUR REGARDLESS OF ITS LOCATION OR DEPTH. IN SUCH CASES, A LARGE DOSE CAN BE DIRECTED TO A VERY SMALL PART OF THE BODY WITHOUT DANGER.



HERE, RADIOACTIVE IODINE, WHICH IS READILY ABSORBED BY THE THYROID GLAND, IS USED FOR BOTH DIAGNOSIS AND TREATMENT.



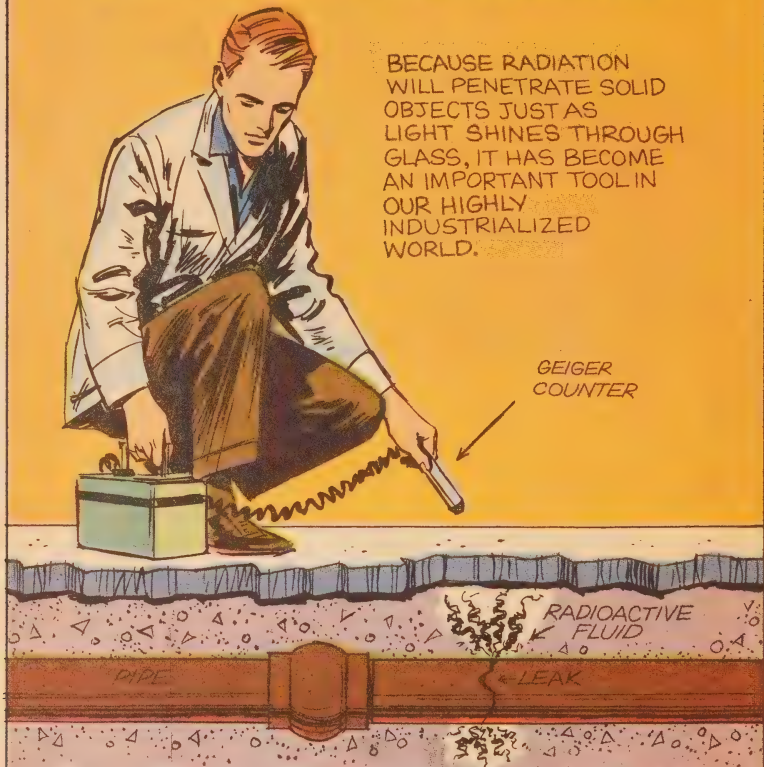
RADIOACTIVE "TRACERS" ARE USED TO DETERMINE KIDNEY FUNCTIONS AS WELL AS IN THE STUDY OF BLOOD CIRCULATION, THE LOCATING OF BRAIN TUMOURS AND OTHER MEDICAL APPLICATIONS.



RADIATION IN INDUSTRY

BECAUSE RADIATION WILL PENETRATE SOLID OBJECTS JUST AS LIGHT SHINES THROUGH GLASS, IT HAS BECOME AN IMPORTANT TOOL IN OUR HIGHLY INDUSTRIALIZED WORLD.

GEIGER
COUNTER



BY FOLLOWING THE COURSE OF SHORT-LIVED RADIOISOTOPES, IT IS EASY TO LOCATE THE LEAK IN A BURIED WATER MAIN OR SIMILAR TRANSMISSION PIPE.

IN THE DEVELOPMENT OF
BETTER QUALITY TIRES
(AS JUST ONE EXAMPLE)
RADIOACTIVE MATERIALS
MIXED WITH REGULAR
INGREDIENTS WILL
INDICATE THE RATE
AT WHICH THE TIRE
WILL WEAR DOWN.

IN CONSTRUCTION, THE
PENETRATING POWER OF
RADIATION IS USED TO
INSPECT WELDS, CASTINGS,
ETC. BY RECORDING FLAWS
ON X-RAY FILM.

X-RAY FILM

ON THE PRODUCTION LINE,
RADIATION GAUGES ARE USED
TO CONTROL LEVELS OF FLUIDS,
THICKNESSES OF PAPER,
ALUMINUM, COPPER, STEEL,
GLASS AND IN MANY OTHER
WAYS—WITHOUT EVER TOUCHING
THE MATERIAL.



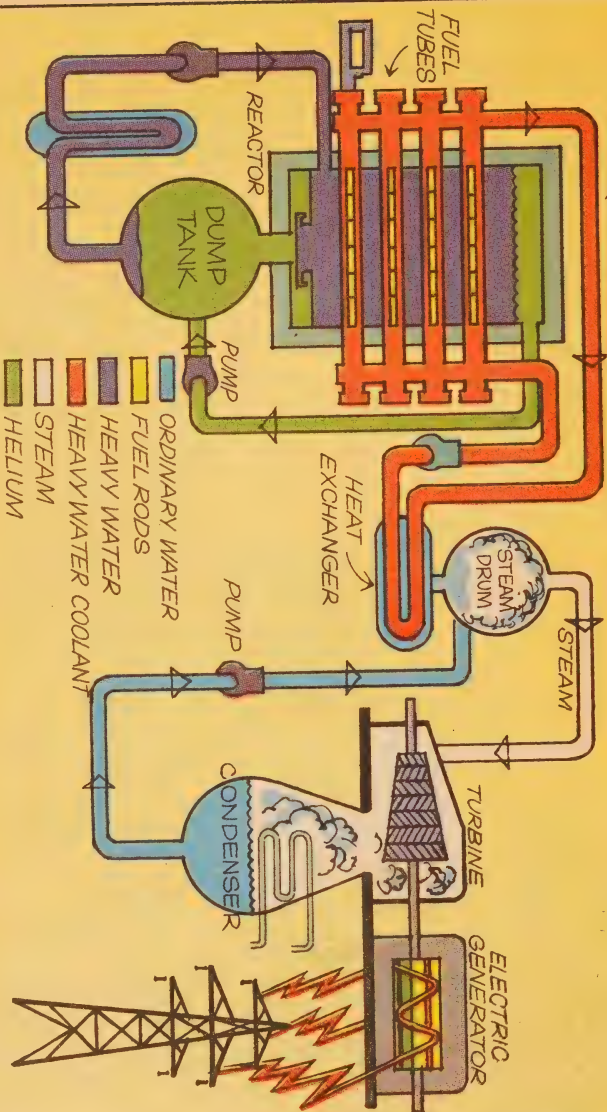
THE STERILIZATION OF
MEDICAL SUPPLIES BY
GAMMA RADIATION IS
A NEW DEVELOPMENT.
THE SUPPLIES CAN BE
SEALED IN CONTAINERS
BEFORE IRRADIATION,
THEREBY ENSURING
THAT THEY REACH THEIR
DESTINATION IN A
STERILE CONDITION.



NUCLEAR POWER PLANT

(DIAGRAMMATIC)

SPLITTING ATOMS PRODUCE HEAT.
HEAT PRODUCES ELECTRICITY.



RADIATION IN AGRICULTURE

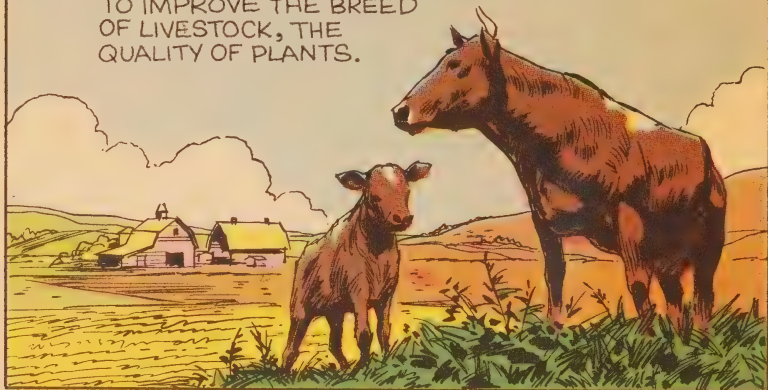
RADIOISOTOPES ARE BEING PUT TO WORK TO IMPROVE THE FOOD THAT WE EAT AND TO HELP BIOLOGISTS LEARN WHAT MAKES PLANTS LIVE AND GROW.



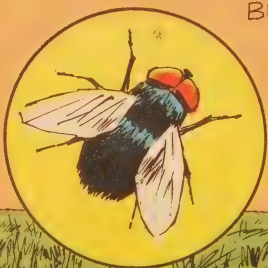
EXPERIMENTAL STATIONS ARE PRODUCING NEW STRAINS OF PLANTS WHICH MEANS MORE PLentiful, DISEASE-RESISTANT CROPS.



THROUGH THE MARVEL OF RADIATION IT IS POSSIBLE TO OBSERVE HOW MINERAL NUTRIENTS MOVE THROUGH ANIMALS OR FRUIT AND VEGETABLES. FROM THIS, SCIENTISTS CAN DETERMINE WHAT NEEDS TO BE ADDED TO IMPROVE THE BREED OF LIVESTOCK, THE QUALITY OF PLANTS.

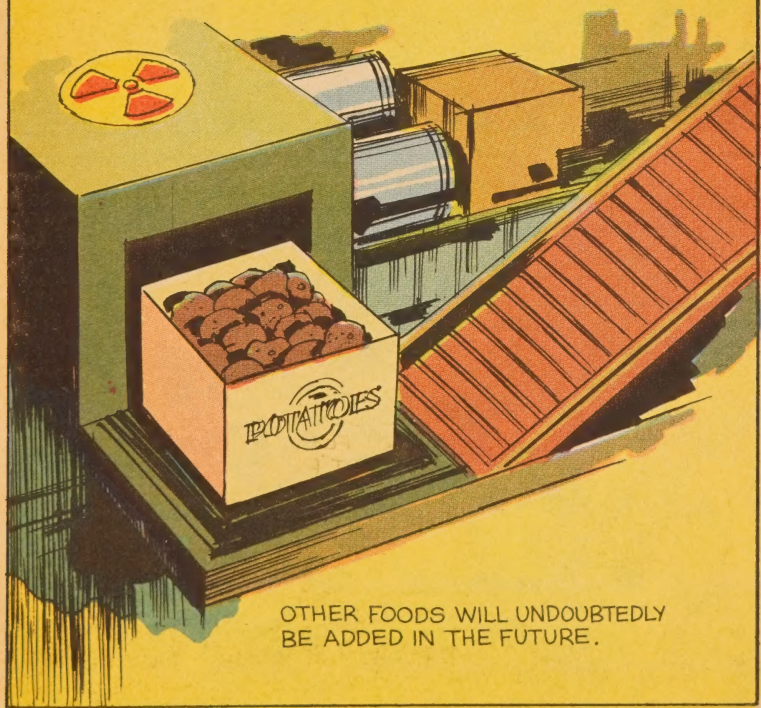


INSECT CONTROL, BY USING INTENSIVE GAMMA RADIATION TO IRRADIATE SOME OF THE MALES OF THE SPECIES, THEREBY PRODUCING STERILE EGGS IN THE FEMALE WITH WHICH THEY MATE, HAS BEEN EXTREMELY EFFECTIVE IN THE CASE OF THE SCREW-WORM FLY AND OTHER INSECT PESTS.

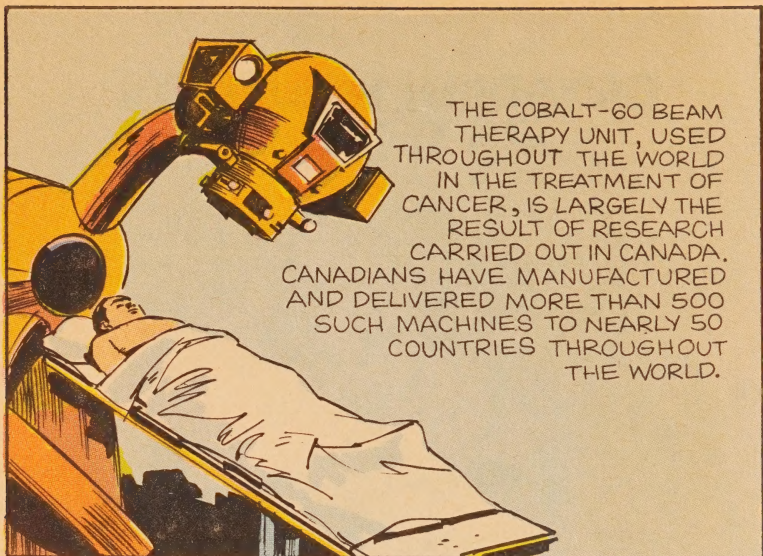


CANADIAN SCIENTISTS ON THE JOB

THIS MODERN USE OF IRRADIATION WAS DEVISED BY SCIENTISTS OF **ATOMIC ENERGY OF CANADA LIMITED**. BY EXPOSING FRUIT AND VEGETABLES TO GAMMA RAYS OF COBALT-60, THESE PRODUCTS ARE ABLE TO RETAIN THEIR FRESH QUALITY AFTER WEEKS OF TRAVEL AND STORAGE.

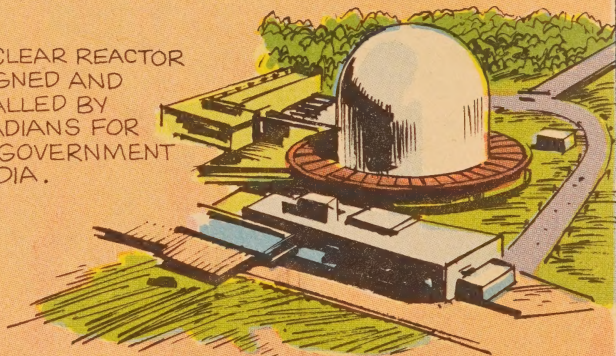


OTHER FOODS WILL UNDOUBTEDLY
BE ADDED IN THE FUTURE.



THE COBALT-60 BEAM THERAPY UNIT, USED THROUGHOUT THE WORLD IN THE TREATMENT OF CANCER, IS LARGELY THE RESULT OF RESEARCH CARRIED OUT IN CANADA. CANADIANS HAVE MANUFACTURED AND DELIVERED MORE THAN 500 SUCH MACHINES TO NEARLY 50 COUNTRIES THROUGHOUT THE WORLD.

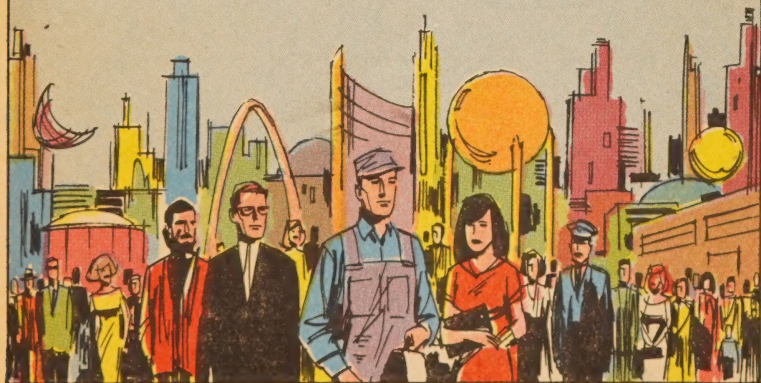
A NUCLEAR REACTOR DESIGNED AND INSTALLED BY CANADIANS FOR THE GOVERNMENT OF INDIA.



THESE ARE JUST TWO OF THE MANY INSTANCES WHERE CANADIAN SCIENTIFIC ACHIEVEMENTS IN THE FIELD OF NUCLEAR ENERGY HAVE BEEN RECOGNIZED BEYOND OUR BORDERS.

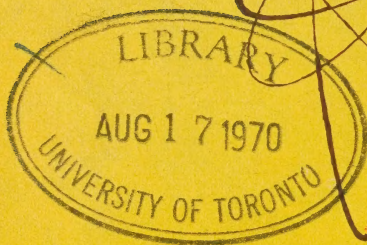
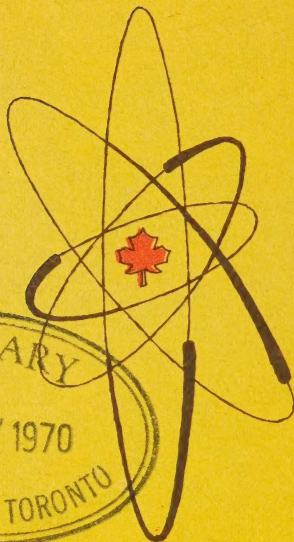
NEW BOON TO MANKIND

THE BENEFITS OF NUCLEAR RADIATION THAT WE KNOW TODAY ARE NOTHING WHEN COMPARED TO WHAT WE MAY REASONABLY EXPECT IN THE FUTURE. FOOD MAY BE PRESERVED IN ITS ORIGINAL FRESH CONDITION FOR LONG PERIODS OF TIME; NUCLEAR-POWERED SHIPS, AIRCRAFT MAY TRANSPORT MILLIONS OF PEOPLE IN EXTREME COMFORT, CLEANLINESS AND SPEED; TRAINS MAY CROSS CONTINENTS MANY TIMES ON ONLY A FEW OUNCES OF NUCLEAR FUEL; POWER REACTORS MAY HELP OPEN UP REMOTE AREAS, SUCH AS CANADA'S NORTH; GREATER AND GREATER USE WILL BE MADE OF RADIOACTIVE MATERIALS IN INDUSTRY, MEDICINE AND RESEARCH. IN TIME IT IS POSSIBLE THAT NUCLEAR POWER MAY LEAD TO TEMPERATURE-CONTROLLED, GERM-FREE CITIES AND A BETTER LIFE FOR ALL MANKIND.



V/F

*Canada. National Health &
welfare dept*



PREPARED IN CONSULTATION WITH
THE DEPARTMENT OF NATIONAL HEALTH AND WELFARE
AND THE CANADIAN NUCLEAR ASSOCIATION

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